THE ANIMAL PARASITES WHICH WE OBTAIN THROUGH OUR FOOD.

A Lecture Before the Sanitary League of Washington, D. C. (Abbreviated).

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AS I am to show you some of the animal parasites which we may obtain from food, permit me to invite you all to lunch with me for half an hour or so that you may see some of the wonderful objects it is possible for us to swallow without knowing it. The repast, to which I now invite you, is not such a one as you would yourself prepare, but it is one which might be prepared by the ignorant and slovenly servants of ladies who consider it a disgrace to know anything about household matters. For your comfort, however, I will tell you that a number of the parasites which I shall mention are not found in Washington, except as specimens in the various scientific collections.

Our first course consists of soup—let it be any kind you wish, bouillon, mock-turtle or anything else. As we are about to take a spoonful we notice a curious object floating around in it, which upon closer inspection turns out to be a small beetle (*Blaps mucro nata*) closely related to our death-watch beetle. If we swallow this bug, the insect itself would not injure us in the slightest, for it would be digested, but according to the investigation of an Italian zoölogist, a little organism lives in this insect which upon coming into our digestive tract and becoming free from the body of the bug, develops into the parasite known to the scientist as a thorn-headed worm (*Echinorhynchus moniliformis*). This is a curious worm, about 2 to 4 inches long, with a strong proboscis on its anterior end, armed with several rows of hooks. Like many other parasites, it possesses no intestine, but, fastened with its head in the wall of our digestive tract, it floats in the contents and absorbs nourishment through its entire outer surface. For your comfort, I will state that this is not a common parasite in man, but lives in rats. The rats scatter the eggs around, and these are swallowed by beetles, in which the larval form develops. When the insects are eaten by rats, or persons, the larvæ then develop into the adult and the life-cycle is thus completed. It may be interesting for you to know that when the Egyptian ladies wish to become stout, they are said to eat a beetle of this genus, and thus they lay themselves open to possible infection with these worms. Perhaps instead of finding a *Blaps* in our soup, we discovered some other bug, say a small butterfly, by the name of *asopia farinalis*, or a beetle known to scientists as *akis spinosa*. In that case, instead of becoming infected with the thorn-headed worm, we should have caught a small tapeworm (*Hymenolepis*).

You may think I have stretched a point by saying that these bugs may be found in soup, but I assure you that it is not an uncommon occurrence to find insects in soup, and that people swallow these insects, containing the germs of various parasites, is shown by the fact that the parasites I have mentioned occur in man, and that the only way he could possibly catch them is by swallowing the insects I have referred to.

While our soup plates are being removed we unconsciously nibble at a piece of bread, at the same time that we are discussing the weather or some other equally exciting topic. Now let us suppose that this bread was cut by our cook —who, as I intimated, is not the most cleanly person in the world. The cook may herself be infected with pin-worms; she has unconsciously gotten some of the microscopic eggs upon her hands,

and in cutting the bread has unconsciously transferred them to the bread. They are too small for us to see, and in eating the bread, we accidentally become infected wlth these germs. Pin-worms (*Oxywris vermicularis*) are among the most common animal parasites found in human beings; probably fully one-fourth, possibly one-third, of the persons in this room have at some time during his or her life-time harbored these creatures. If only a few worms were present, we were not troubled very much, but if many were present we probably were quite unhappy for the time-being, notwithstanding the enormous doses of soothing syrup or other mixture which our well-intending mothers gave us to keep us from being so restless during the night, little suspecting what the real cause of our restlessness was ! These parasites are, as I said, very common and may be obtained through solid food which has been handled by persons who are affected with them, and are not careful enough about washing their hands, or they may be obtained through unfiltered or unboiled drinking water, or through milk when the milk-can, before leaving the farm, or even afterwards, has accidentally (?) stood for a few minutes too near a contaminated water supply.

If our servant has allowed the lid of the bread-box to stand open, and mice have gotten in there, they have scattered on the bread microscopic parasites known to the zoölogist as *Megastoma intestinale* and as we eat the bread we become infected with these germs also.

Our fish has now been served. Some of us have taken pike, others have taken turbot, still others have chosen some other fresh-water fish, but the essential point is that the fish has not been cooked enough. As we are eating this fish, one of us, who perhaps has sharper eyesight than the rest, discovers a white object about one-fourth to one-half inch in length, which differs slightly from the muscle. This object upon closer inspection proves to be the germ or larval stage of the broad Russian tape-worm (*Bothriocephalus latus*), which is the largest parasite found in man. The worm grows to be 32 feet in length. I spoke of it as a worm. In ordinary parlance we generally call a tape-worm a single animal, but scientifically speaking, the tape-worm is a colony of animals. The head, provided with two suckers by means of which it holds fast to the wall of our intestinal tract, is what we have swallowed as a germ or larva, with the fish, and represents the mother of the colony; while these segments, of which there may be hundreds, each represent individual worms of a second generation, the mother and all her daughters remaining joined together as a colony. It may be a satisfaction for you to know that this parasite is rare in America.

As our fish-plates are removed and we are waiting for the next course consisting of meats, we introduce a new topic of conversation, by taking a sip of unfiltered and unboiled water. It would have been better, perhaps, had we not taken that particular drink, for we have run the risk of swallowing the germs of a number of different parasites.

We might perhaps have swallowed the eggs of the ordinary lumbricoid worm (*Ascaris lumbricoides*), of which I show you several specimens in this bottle, and of which you see some figures on this chart. This is one of the most common of the parasites found in the human species. I do not know how common it is in Washington, but I have records of examinations of 7547 persons in certain European cities, and of this number 962 persons, or 12.7 per cent., or about one person in every eight, were infested with this worm, and there is no reason to suspect that the worm is any less frequent in this city. It is especially frequent among school-children, negroes and idiots, in fact among all classes of people who are not cleanly about their personal habits, and who drink unfiltered or unboiled water. In cities like Paris, where the entire water supply is filtered, the worm is exceedingly rare.

If we happened to be in Egypt, or in certain parts of Asia, we might have become infested with another worm, the guinea-worm by name (*Dracunculus medinensis*), which some scientists look upon as the fiery serpent of the children

of Israel. This parasite, of which there is probably only one specimen in the United States, is about a yard long and lives under the skin; it produces large swellings, accompanied by an intense burning sensation, hence the name fiery serpent or fiery dragon, which it retains to the present day. The parasite is caught by swallowing small crustaceans in unfiltered drinking water, for the larval stage of this worm lives in these minute crabs, *Cyclops* by name.

Although we are not liable to catch the fiery serpent of the children of Israel in this part of the world, there is a somewhat similar parasite which we do stand in danger of catching. This worm, which scientists call a thread-worm (*Filaria sanguinis hominis*), lives in various parts of the body; the young embryos of the worms are found in the blood and are so small, about 1-1000 of an inch long, that a large number may be found in a single drop of blood. Now when mosquitoes bite a person infected with these worms, the insects swallow a number of these microscopic germs along with the blood. The worms grow somewhat while in the body of the mosquito, and then when Mrs. Mosquito, after spending four or five days digesting her meal, goes to some body of water to deposit her eggs, the worms are ready for the next step in their life-history. After the mosquito dies and falls into the water, the young worms devour the internal organs of the insect, leave the mosquito and swim around until they are swallowed by the person who is careless enough to drink unfiltered or unboiled water.

In some other parts of the world another very curious animal is caught from the water, an animal about half an inch long, which spends its earlier stages in a small crab, but which after being swallowed by man lives in the large veins in his abdomen and causes a very serious disease.

But we have caught enough parasites from that drink of water—let us pass on with our lunch. We have before us on the table a number of different kinds of meat. Some of us may prefer tongue or roast beef; others may prefer pork of some kind, say roast pork, boiled ham, or if we are inclined towards German customs we may take some duck stuffed with sausage. Let each one select his or her own meat and I will tell you what parasite you have swallowed, taking it for granted that all of the meats are underdone.

Those who have chosen beef in any form, as tongue, roast beef, smothered beef, steak or stuffed veal, etc., have run the risk of catching the so-called beef-measle tape-worm (*Tænia saginata*). This is the most common of the eight different species of tape-worms found in man. It is generally about fifteen to thirty feet long and is made up of a head and about 1200 to 1300 segments, each one of which you will recall represents a separate worm. These small bladder-like structures, about the size of a small bean, resemble bits of fat to a certain extent. These are the objects you swallow when you catch a beef-measle tape-worm. This cyst contains a tape-worm head, bearing four suckers. When this is swallowed segments begin to form very rapidly. In treating for tape-worm it is always necessary to get rid of this head, for if that remains in the body the tape-worm will grow again.

Those of us who chose pork chops, roast pork, ham or duck stuffed with pork sausage, have of course escaped the danger of becoming infested with the beef-measle tape-worm, but have run the risk of catching a smaller but still more dangerous tape-worm *i. e.*, the pork-measle tape-worm (*Tænia solium*). The object we swallow in this case is almost identically the same as the object we would have swallowed had we eaten beef. The bladder-worm (*Cysticercus cellulosæ*) lies in the muscle, surrounded by connective tissue, and as it comes into our stomach, the surrounding cyst is digested. The head and neck pass to a point in our digestive tract a little way below our stomach and then begins the formation of segments, the segments always forming near the head, so that the last segment, that is, the segment furthest from the head, is the oldest, while the segment nearest the head is the youngest.

I said that this tape-worm is more dangerous than the beef tape-worm. Not because it causes us more pain while in the digestive tract, however, but because the microscopic embryos, which are formed in the segments, can under certain conditions bore through the intestinal wall and reach the inside of the eye or some other part of the body, and there develop into a bladder-worm. In this way man as well as hogs may become infested with pork-measles.

But this is not the only parasite we have run the risk of catching in eating half-cooked pork. We may have eaten a piece of meat infested with the much dreaded trichinæ.

These trichinæ are curious little creatures, and although they are objects of considerable fear to the physician, who knows only too well that if these parasites once gain access to a patient's muscles, he is utterly powerless to reach them and kill them with any medicine known, yet to the zoölogist these worms are of considerable interest.

They are very small, as you will believe when I state that as many as 350,000 may live in a single pound of meat. These minute worms live inside of the muscle-fibre of pork, coiled up like a spiral, with a small cyst around them. When we eat this pork, the meat upon coming into our stomach is digested and these minute cysts are liberated. The juices of our stomach then dissolve the cysts and Mr. and Mrs. Trichina pass down below our stomach and proceed to make life unpleasant for us. Mrs. Trichina becomes the mother of about 10,000 to 15,000 wriggling youngsters within a month's time and these latter bore through our digestive wall and journey to the muscles. Upon arriving at some muscle which they find to let, they bore into it and proceed to take possession of the contractile substance. The more of the contractile substance the trichinæ eat, the less there is for us to use in swallowing, breathing, walking, etc. After some weeks, however, the parasites have satisfied their appetite and they become encysted, and our muscles present the same appearance which the pork had before we ate it. If our physician has succeeded in stimulating us up to the stage when the parasites become encysted, we will recover from the disease, and the trichinæ will do no further harm, until we go to Africa as missionaries, when the savages may suddenly discover that they have a bad case of trichinosis, should they not allow us to carry on our work unmolested. I should not, however, advise that we require candidates for the missionary field to first become infected with trichinæ in order to discipline the cannibals, but had our first delegation of missionaries passed through the disease of trichinosis before going to their fields of labor, the savages would by this time have learned that it was dangerous to use missionaries as an article of food.

I stated that we obtained our trichinæ from half-cooked pork, but you may wonder how the hogs became infected. The matter is very simple indeed. These parasites are also found in rats, and as the hog is very fond of rats as a *delicatesse*, the hogs catch the parasites by eating rats. Rats keep up the infection among themselves by eating each other, for rats are cannibals.

We have perhaps not noticed that the odor of the meat brought our favorite dog into the dining room. He is practically a member of the family and petted by all, none except the scientist looking upon him as anything except a most faithful friend, old Dog Tray! The scientist, however, is hard-hearted enough not to appreciate this friendship, and believing the proper place for a dog is the cellar, the barn-yard, the dissecting room or the dog-pound, he hygienically looks upon the dog as his enemy. Nevertheless some of you do not share these opinions and as the dog comes to you, you pet him and allow him to sniffle and lick your hand. But let us look for a moment at the animal parasites which the dog has given to you during that short caress!

Beloved old Dog Tray has in his nose a parasite about two to five inches long, a so-called tongue-worm (*Linguatula rhinaria*); in sniffling and licking your hand he has deposited there some microscopic eggs, and the next time you take a piece of bread you will transfer these

eggs on the bread to your mouth. The eggs will be swallowed and the germ will bore from your digestive tract into your liver, and there develop into a parasite about one-quarter to one-half an inch long.

Or in caressing the dog you have unconsciously gotten a flea or a louse upon your hands, perhaps under your finger-nails, and later you have swallowed that. It may now be a comforting thought for you to know that inside of that flea or louse there lives the larval stage of a tape-worm (*Dipylidium caninum*) with which you have become infected. But that is not all.

The most dangerous animal parasite which man has, is a so-called hydatid, which is the larval stage of a small tape-worm (*Tænia echinococcus*), found in the dog. From the very nature of the habits of the dog we must not be surprised to find the eggs of this tape-worm upon his coat. Petting him, you get these eggs upon your hands; from your hands to your mouth is but a short distance; you swallow the eggs and have become infected with the dreaded *Echinococcus!* The echinococcus develops in your liver, in your lungs, in your brain or elsewhere and you suddenly discover the fact too late—perhaps it is not you who discovers it after all, but the physician who makes your post-mortem, that the dog is your enemy rather than your friend. I am not now referring alone to the miserable collections of animated bones and dog-skins which wander into our city from Virginia and Maryland, but I refer to mamma's darling little poodle as well. In fact, from statistics it appears that this hydatid parasite to which I refer is most frequent among the dirty Icelanders who live in the same huts with their dogs, frequently sharing the same plate, and next in frequency in women who keep pet lap-dogs.

But our salad has come on the table. This salad—let it be any kind you prefer—was grown in a rather damp field; the year was perhaps an unusually damp year; and Bridget or Amanda is particularly lazy to-day and did not wash the salad as well as she would have done, had she expected that you would inspect the various courses before they came on the table. Let us see what parasites we swallow this time.

First of all, we swallow a most remarkable animal, known as the common liver-fluke (*Fasciola hepatica*), a parasite which is not particularly frequent in man but one which is more common in sheep and cattle. A parasite which in 1830 killed more than 2,000,000 sheep in England, causing an estimated loss of $20,000,000; and one which killed 1,000,000 sheep in Buenos Ayres in 1882; a parasite which kills hundreds of cattle and sheep in Texas every year and has recently swept off nearly all the cattle on some of the Sandwich Islands. This parasite lays about 45,000 eggs, in each of which, under favorable conditions, a small ciliated embryo develops; this embryo swims around in the water until it finds a certain swamp-snail, into which it bores its way. Upon coming to rest (as a sporocyst) it produces a third generation (redia) which is however very unlike the first or second. This produces still another different generation (cercaria) which leaves the snail and encysts itself upon some plant, say the kind used in our salad. When we swallow this cyst, the animal seeks out our liver and developing into the adult, proceeds to make trouble for us.

Nor is this the only fluke which we might catch in eating salad. A smaller one, the lancet-fluke of Germany (*Distoma lanceolatum*) or the Japanese liver-fluke (*D. sinense*) may be gotten in this way. The Chinese lung-fluke, which also lives in cats and tigers and which Dr. Ward has recently found in this country, might make their homes with us, brought to us by improperly prepared salad.

But I have introduced enough parasites to you to show you the necessity of preparing food carefully before it is placed upon the table. I hope I have not taken your appetites away for your meals to-morrow by making you disgusted with food, although I cannot say that I should feel very sorry if I have made you disgusted with pet dogs. Remember, that if your food is properly prepared, if your drinking water is boiled or filtered, and if you keep dogs from becoming too intimate friends with you, there is abso-

lutely no danger of your catching any of these parasites that I have mentioned, but, if you will insist upon allowing your pet poodle the privileges of the dining room, if you are careless about boiling or filtering your drinking water, and if you allow your careless servants to prepare your food as they wish, you in the meantime feeling it beneath you to enter the kitchen and see how matters are going on, you lay yourselves open to infection not only by these parasites of which I have spoken, but by many others.

THIS again is the season when milk requires such careful inspection. The sick, the young and, indeed, so many persons rely on city milk for food and nourishment, that the food inspectors should be doubly alert to detect impure milk. Unfortunately it is only by bacteriological tests that some of the most dangerous contaminations of milk can be found and as this requires special skill and consequently entails increased expense, there are few places that can afford the cost. Typhoid fever, that wasting and destroying disease, that has just played such havoc in Montclair, Buffalo and other places, is caused by impure milk infected with contaminated water, and this a bacteriologist alone can detect. The chemical tests may show a pure article and the lactometer may register at normal and yet the deadly typhoid germ, long-lived and very resistant, cruelly awaits its victim in this apparently pure liquid. Boiling milk is a thoroughly protective method but the means of inspection in every place should be so perfect that boiling would not be necessary.

THE time is now at hand when cases of supposed poisoning by ice cream, crabs and other articles of diet will be announced by the daily press. These are generally cases of actual poisoning, but not such as occur from real poisons placed with evil intent. The poisonous substance may be evolved by a chemical change in the food either before or after it is taken into the stomach. It is no easy matter to tell with accuracy when crabs were picked and the opportunities for unscrupulous dealers in hot weather to work off stale crab meat in shells are very favorable and the temptation is very strong. If crabs must be eaten, they should be bought alive and cooked at home or under the supervision of some one to be trusted. As for ice cream poisoning, it is very hard to say when it may occur and there is no known means to prevent it; one sample may contain poisonous properties and another be free from them. On the whole, when a reliable dealer supplies the ice cream and it is known that the milk and other ingredients are fresh, the chances of poisoning are much less. It is very often that sharp competition in supplying large gatherings with food at a picnic or excursion leads to poisoning. This subject comes under the general head of food inspection, and when States and cities pass and enforce laws for the proper inspection of food and drink, then will the chances of poisoning be reduced to a minimum.

BALTIMORE has been visited by a short attack of small-pox, which the efficiency of the health commissioner's staff has kept completely in check. The disease started with some colored members of a theatrical troup and spread to others of the same race and to a few white. This reminds us that the African race is peculiarly susceptible to small-pox, just as it is especially proof against yellow fever. Therefore the cities like Washington, Baltimore and southern cities in general should be on their guard and vaccinate promptly and effectively.

BEFORE long, Asiatic cholera, like the Asiatic plague, the Bubonic pest, and their modern correlative, typhus fever, will become extinct among European nations, and survive only as the records and relics of a historic shame, says one of the greatest of modern sanitarians. Cholera, being a preventable disease, is a reproach to any nation.